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PATENT

AF/3726  
JFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 09/862,688  
Filing Date: May 22, 2001  
Applicant: D. Mauer et al.  
Group Art Unit: 3726  
Examiner: E. Omgba  
Title: RIVETING SYSTEM AND PROCESS FOR FORMING A RIVETED JOINT  
Attorney Docket: 0275M-000260/DVB

Hon. Commissioner of Patents and Trademarks  
Washington, D.C. 20231

**RESPONSE TO NOTIFICATION OF NON-COMPLIANT APPEAL BRIEF**

A "Resubmission of Appellant's Second Appeal Brief" is being filed in response to the Notification of Non-Compliant Appeal Brief. The Examiner's basis for the Notification is respectfully traversed. It is believed that the previously filed Second Appeal Brief was fully compliant. Notwithstanding, the Resubmission has modified Section IV-Status of Amendments, added a new first sentence to Section V-Summary of the Invention, and changed the heading for Section VI-now, Grounds of Rejections to be Reviewed on Appeal, pursuant to the Examiner's comments in the Notification. The Table of Authorities and the formatting of Claim 75 in the Appendix has also been revised.

Respectfully submitted,

Dated:

August 1, 2005

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PTO/SB/21 (04-04)

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	First Named Inventor	D. Mauer et al.
	Art Unit	3726
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ENCLOSURES (check all that apply)		
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Firm or Individual name	Harness, Dickey & Pierce, P.L.C.	Attorney Name Monte L. Falcoff	Reg. No. 37,617
Signature			
Date	August 1, 2005		

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Washington, D.C. 20231

**RESUBMISSION OF APPELLANT'S SECOND APPEAL BRIEF**



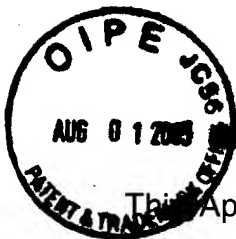
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This Appeal is filed under 37 C.F.R. §1.192 from the Final Rejection of Claims 12, 15, 16 and 18-77, as provided in the Final Office Action dated November 18, 2004 and Advisory Action dated January 26, 2005. The Notice of Appeal was filed by mail on February 18, 2005.

### **I. REAL PARTY IN INTEREST**

The owner of the present patent application is Newfrey LLC by way of an assignment recorded on November 26, 2002 at reel/frame 013516/0757. It was previously assigned to Emhart LLC from Emhart Inc. by an assignment recorded on April 18, 2002, at reel/frame 013036/0919; and before that to Emhart Inc., by way of an Assignment from the inventors recorded on January 31, 2000, at reel/frame 010560/0045.

Emhart LLC, Emhart Inc., Black & Decker Corp., Emhart Fastening Technologies and Emhart Tucker, GmbH are companies related by ownership with Newfrey LLC.

### **II. RELATED APPEALS AND INTERFERENCES**

No related appeals or interferences are presently pending for the present application or applications related thereto by a claim of priority.

### **III. STATUS OF CLAIMS**

Claims 1-11 have been allowed, Claims 13, 14 and 17 have been objected to and Claims 12, 15, 16 and 18-77 stand finally rejected and are the subject of this

Appeal. A clean copy of the amended claims involved in the Appeal is attached hereto in Appendix A.

#### **IV. STATUS OF AMENDMENTS**

An Amendment After Final was filed on January 5, 2005 responsive to a second Final Office Action dated November 18, 2004. The Amendment After Final was entered in the Advisory Action dated January 26, 2005. All of the amendments have been entered.

#### **V. SUMMARY OF THE INVENTION**

The following concise explanation of the subject matter from the application relates to the subject matter of each of independent Claims 12, 22, 34, 43, 48, 50,56, 63 and 71 involved in this appeal.

Referring to Figures 1 and 2, a joining device for punch rivets, hereinafter known as a riveting system 21, includes a riveting machine or tool 23, a main electronic control unit 25, a rivet feeder 27, and the associated robotic tool movement mechanism and controls, if employed. Riveting tool 23 further has an electric motor actuator 29, a transmission unit, a plunger 31, a clamp 33 and a die or anvil 35. Die 35 is preferably attached to a C-shaped frame 37 or the like.

The transmission unit of riveting tool 23 includes a reduction gear unit 51 and a spindle drive mechanism 53. Plunger 31, also known as a punch assembly, includes a punch holder and punch. A data monitoring unit 61 assists in monitoring signals from the various sensors. (Application at p. 7, lines 4-20).

Figures 4 and 6 show a nut housing 101 directly connected to a central shaft of spur gear 81. Therefore, rotation of spur gear 81 causes a concurrent rotation of nut housing 101. A load cell 103 is concentrically positioned around proximal segment of nut housing 101. Load cell 103 is electrically connected to monitoring unit 61 (see Figure 1). (Application at p. 8, lines 15-22).

A rotatable nut 111, also known as a ball, is directly coupled with nut housing 101 such that rotation of nut housing 101 causes a simultaneously corresponding rotation of nut 111. A spindle 115 has a set of external threads which are enmeshed with a set of internal threads of nut 111. Hence, rotation of nut 111 causes linear advancing and retracting movement of spindle 115 along a longitudinal axis. A punch holder 121 is bolted to spindle 115 for corresponding linear translation along the longitudinal axis. A punch 123 is longitudinally and coaxially fastened to punch holder 121 for simultaneous movement therewith. (Application at p. 9, lines 4-13).

Referring to Figures 6 and 15, a spindle position proximity switch sensor 201 is mounted within riveting tool 23. A plate thickness proximity switch sensor 205 is also mounted within riveting tool 23. Additional proximity switch sensors 281 and 283 are located in a feed tube for indicating the presence of a rivet therein in a position acceptable for subsequent insertion into the receiver of riveting tool 23. These proximity switches 201, 205, 281 and 283 are all electrically connected to main electronic control unit 25. Furthermore, a resolver-type sensor 211 is connected to electric motor 29 or a member rotated therewith. Resolver 211 serves to sense actuator torque, actuator speed and/or transmission torque. The signal is then sent by the resolver to main



electronic control unit 25. An additional sensor connected to electric motor 29 is operable to sense and indicate power consumption or other electrical characteristics of the motor which indicate the performance characteristics of the motor; such a sensed reading is then sent to main electronic control unit 25. (Application at p. 10, line 11, through page 11, line 6).

Figure 10 illustrates a feed tube 271 secured to receiver 241 (see Figure 8) and feeder 27 (see Figure 2). Entry and exit proximity switch sensors 281 and 283, respectively, monitor the passage of each rivet through feed tube 271 and send the appropriate indicating signal to main electronic control unit 25 (see Figures 2 and 15). The rivets are pneumatically supplied. (Application at p. 11, line 20 through p. 12, line 7).

Figure 9 shows an alternate embodiment system. A drive shaft 411 of drive unit 401 is connected to a belt wheel 412 of a transmission unit 402. Belt wheel 412 drives a belt wheel 414 via an endless belt 413. (Application at p. 13, lines 3-9).

Returning to the preferred embodiment, Figures 12a-13e show the riveting process steps. The preferred rivet employed is of a self-piercing and hollow type which does not fully pierce through the die-side workpiece. (Application at p. 18, lines 4-7).

A simplified electrical diagram of the preferred embodiment riveting system is shown in Figure 14. A separate microprocessor controller 61 is connected to main electronic control unit 25 which measures the position of the spindle through a digital signal. Controller 61 receives an electric motor signal and a resolver signal. The load cell force signal and the proximity switch signals (from the feeder, feed tube and spindle home position sensors) are sent to main electronic control unit 25. A gateway

transmits data from main electronic control unit 25 to a host system which displays and records trends in data such as joint quality, workpiece thickness and the like. (Application at p. 19, line 19, through p. 20, line 13).

Figure 16 is a force/distance (displacement) graph showing a sequence of a single riveting operation or cycle. The first spiral spring distance range is indicative of the force and displacement of punch 123 due to light spring 128. The next displacement range entitled hold down spring, is indicative of the force and displacement generated by heavy spring 141, clamp 143 and the associated clamping nose piece 249. Measurement of the sheet metal/workpiece thickness occurs at a predetermined point within this range by way of load cell 103 interacting with main electronic control unit 25. In the next rivet length range, the rivet length is sensed and determined through load cell 103 and main electronic control unit 25. The middle line shown is the actual rivet signature sensed while the upper line shown is the maximum tolerance band and the lower line shown is the minimum tolerance band of an acceptable rivet length for use in the joining operation. If an out of tolerance rivet is received and indicated then the software will discontinue the riveting process and send the appropriate error message.

Figure 17 shows a force versus distance/displacement graph for the rivet setting point. The sensed workpiece thickness, the middle line, is compared to a prestored maximum and minimum thickness acceptability lines within the main electronic control unit 25. This occurs at a predetermined distance of movement by the clamp assembly from the home position or other initialized position. The rivet length (or other size or material type) signature is also indicated and measured. Load cell 103

senses force of the clamp assembly and punch assembly. The workpiece thickness is determined by comparison of a first sensed force value at a preset displacement versus a preprogrammed force value at that location. Subsequently sensed force values are also compared to preset acceptable values; these subsequent sensed force values are indicative of rivet size and joint quality characteristics. The computer is always on-line with the tool and process in a closed-loop manner. This achieves a real time control of the process through sensed values. (Application at p. 20, line 15, through p. 21, line 21).

The accuracy of riveting, as well as measurements in the preferred embodiment, are insured by use of the highly accurate electric servo motor and rotary-to-linear drive mechanism employed. For example, the rivet can be inserted into the workpieces with one tenth of a millimeter of accuracy. The control system of the present invention also provides a real time quality indication of the joint characteristics, rather than the traditional random sampling conducted after many hundreds of parts were improperly processed. Thus, the present invention achieves higher quality, greater consistency and lower cost riveted joints as compared to conventional constructions. (Application at p. 23, line 18, through p. 25, line 5)

#### **VI. GROUNDS OF REJECTIONS TO BE REVIEWED ON APPEAL**

The issues are as follows: (A) Claims 12, 15, 20, 21, 50 and 54 stand rejected under 35 U.S.C. §103 (a) as allegedly being unpatentable over Speller (U.S. Patent No. 5,829,115) in view of IBEC (Body Assembly & Manufacturing, September 1994); (B) Claims 51 and 52 stand rejected under 35 U.S.C. §103 (a) as allegedly being

unpatentable over Speller, IBEC and Gast (U.S. Patent No. 4,901,431); (C) Claim 16 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller IBEC and Zeldman et al. (U.S. Patent No. 3,878,734); (D) Claims 22-30, 33, 34, 43, 44, 56, 57 and 59-61 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller in view of Cotterill (U.S. Patent No. 5,752,305); (E) Claims 31, 32, 35-42 and 45-47 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Cotterill and Gast; (F) Claim 48 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, in view of IBEC and Gast; (G) Claims 49 and 55 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, IBEC, Gast and Cotterill et al.; (H) Claim 58 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Cotterill and the Affidavit of John Vrana; (I) Claim 62 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Cotterill, IBEC and Gast; (J) Claims 63 and 71 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Cotterill and Vrana; and (K) Claims 64-77 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Cotterill, Vrana and IBEC.

## **VII. GROUPING OF CLAIMS**

Based on the final rejections applied by the Examiner, all of the claims at issue stand or fall separately from each other for at least the reasons stated in the Argument section of this brief.

## **VIII. ARGUMENT**

### **A. Legal Errors by Examiner re: Declarations and License Demonstrating Secondary Considerations, Applicable to Most Claims**

Three Declarations and a license relevant to the present application have been filed. The Examiner, however, has not given these evidentiary items their proper weight, if any at all.

“A prima facie case of nexus is generally made out when the patentee shows both that there is commercial success, and that the thing (product or method) that is commercially successful is the invention disclosed and claimed in the patent. When the thing that is commercially successful is not coextensive with the patented invention – for example, if the patented invention is only a component of a commercially successful machine or process – the patentee must show prima facie a legally sufficient relationship between that which is patented and that which is sold.” *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 7 U.S.P.Q.2d 1222, 1226 (Fed. Cir. 1988). The Examiner can only rebut this prima facie case of nexus with tangible evidence that the commercial success was due to extraneous factors other than the patented invention such that the Examiner’s mere argument and conjecture are insufficient. *See, Id.* at 1226-27. Furthermore, a “patentee is not required to prove as part of its prima facie case that the commercial success of the patented invention is *not* due to factors other than the patented invention.” *Id.* at 1227. “When a prima facie case is made and not fully rebutted, the . . . [patent office] may not totally ignore the objective evidence.” *Id.* (emphasis added).

More specifically, the Declaration of Dieter Mauer (an inventor of the present application) was originally filed in a related application (with similar claims) and

is of record in the present application. This Mauer Declaration specified in paragraph 3 that the rivet machines sold to Audi contained the mechanical features presently disclosed in the present claims in dispute. The last sentence of paragraph 4 of the same declaration also states “[it] is further my understanding that Audi found the process data monitoring, sensing and controllability for the Emhart Tucker rivet machines to be technically desirable and superior to competitive rivet machines.” This indicates that the rivet machines sold to Audi also had the sensing and control features presently claimed. The control, electric motor, sensor and rotary-to-linear transmission features of the Audi machines are also well documented in the third party, Audi employee declaration of H. Konig paragraphs 3 and 7, thus demonstrating the requisite nexus.

Moreover, the technical basis for these machine acquisitions is significantly supported by paragraph 6 of the Audi employee Konig declaration. Similarly, section 4 of the Mauer Declaration clarifies that Audi purchased these rivet machines “primarily based on their technical merit rather than sales, marketing, advertising or price considerations.” In contrast, the Examiner’s case citations and arguments are distinguishable from the present facts and the Examiner’s application of these cases were overly superficial. Accordingly, the proper nexus between the commercial success and claimed invention has been proven.

The Examiner also improperly dismissed the declarations by requiring market share information. “Although sales figures coupled with market data provides stronger evidence of commercial success, sales figures alone are also evidence of commercial success.” *Tec Air Inc. v. Denso Mfg. Michigan Inc.*, 52 U.S.P.Q.2d 1294,

1299 (Fed. Cir. 1999). This Federal Circuit case should be given more precedential value than the Board of Patent Appeals and Interferences case cited by the Examiner. Notwithstanding, it is believed that Applicants' company, Emhart Tucker GmbH, is one of at least three significant suppliers of related machinery in Europe and the present invention was first presented to customers around 1998 or 1999.

Nevertheless, the subsequent Declaration by assignee's product manager, Ralf England, (filed in the present application on December 12, 2002) overcomes the inadequacies improperly alleged by the Examiner. It ties the commercial success to the claims in the present application as they were pending at that time (with Claims 22, 34 and 48 being unchanged and the others having been broader at that time) and it discusses the market share issue. Furthermore, Sections 3.1 and 3.2 of the redacted SPR Setting Machine Usage Agreement with the Edison Welding Institute (hereinafter "the EWI License", filed in the present application on January 29, 2004), is a license and states that "the product covered by all of the claims of the Licensed Patents [including the present application] has exhibited commercial success, is valuable and is a significant improvement in the industry." The claims pending on the execution date of the EWI License of January 15, 2004, have not changed except for Claims 31, 50 and 54-77. Accordingly, the Examiner legally erred by not properly considering the declarations and license filed in the present application as to commercial success, licensing, significant improvement in the industry and, thus, nonobviousness.

B. Legal Error by Examiner Re: No Suggestion or Motivation to Combine References

The presently claimed combination of elements in all of the claims is new and nonobvious. “Virtually all inventions are combinations of old elements” such that “rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be an illogical and inappropriate process by which to determine patentability.” *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1457 (Fed. Cir. 1998). Furthermore, the references applied by the Examiner do not contain the requisite suggestion or motivation necessary to show obviousness of the claimed invention. *See, Smith Indus. Medical Sys. Inc. v. Vital Signs Inc.*, 51 U.S.P.Q.2d 1415, 1420-21 (Fed. Cir. 1999); *see also, Akamai Technologies Inc. v. Cable & Wireless Internet Services Inc.*, 58 U.S.P.Q.2d 1186, 1193 (Fed. Cir. 2003).

U.S. Patent Publication No. 2002/0166221 (Clew) provides additional evidentiary support that there is no suggestion or motivation to combine the cited hydraulically actuated riveting machines, such as IBEC, with the electric motor actuated device of Speller to arrive at the presently claimed invention. The differences and incompatibility of these prior devices are significant. *See*, for example, Paragraph Nos. [0004], [0005] and [0012] of Clew, where German Application No. EP 0893172, which is the priority basis for the present application, is compared to U.S. Patent No. 5,752,305 (Cotterill). It is also noteworthy that the assignee of Clew is the assignee of Cotterill and is the Henrob Company referenced in the IBEC publication. Furthermore, Clew is not



prior art to the present application. Thereby, not only is there a lack of suggestion or motivation in the prior art to combine the cited references, but some of the references teach away from the alleged combination.

C. Legal Error by Examiner Re: Improper Hindsight Analysis

“Care must be taken to avoid hindsight reconstruction by using the patent-in-suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit.” *Grain Processing Corp. v. American Maize-Prods. Co.*, 5 U.S.P.Q.2d 1788, 1792 (inner quotes omitted); *see also, Cardiac Pacemakers Inc. v. St. Jude Medical Inc.*, 72 U.S.P.Q.2d 1333, 1336 (Fed. Cir. 2004). The Examiner should not “pick and choose among the individual elements of assorted prior art references to recreate the claimed invention.” *Symbol Technologies Inc. v. Opticon Inc.*, 19 U.S.P.Q.2d 1241, 1246 (Fed. Cir. 1991); *see also, In re Wesslau*, 147 U.S.P.Q. 391, 393 (C.C.P.A. 1965). “The prior art as a whole” must “suggest the desirability, and thus the obviousness, of making the combination” of known elements. *Ecolochem Inc. v. Southern California Edison Co.*, 56 U.S.P.Q.2d 1065, 1073 (Fed. Cir. 2000). The Examiner must identify the explicit statements in the prior art that demonstrate the alleged motivation, suggestion or teaching, and broad “conclusory statements standing alone are not ‘evidence’.” *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000; *see also, In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). In this regard, the Examiner has respectfully failed.

D. 35 U.S.C. §103 Rejection of Claims 12, 15, 20, 21, 50 and 54

The Examiner has rejected Claims 12, 15, 20, 21, 50 and 54 under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al. (U.S. Patent No. 5,829,115) and IBEC (Body Assembly & Manufacturing, September 1994). This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references.

1. Scope, Content and Differences of Prior Art

Under 35 U.S.C. §103, “the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.” *Graham v. John Deere Co.*, 148 U.S.P.Q. 459, 467 (U.S. 1966). In the Final Office Action, the Examiner has misstated (a) the scope and content of all of the cited references and (b) the Examiner has incorrectly analyzed the similarity and differences between all of the cited references as compared to the claimed invention.

2. Level of One Skilled in Art

The level of one of ordinary skill in the art of the present application would be a person with a mechanical engineering degree and about five years of experience in the design of riveting machines, or the equivalent practical experience. This skilled artisan would also need to have some exposure to high volume riveting of metal panels in a manufacturing plant, such as an automotive assembly plant.

### 3. Legal and Factual Errors by Examiner

Independent Claim 12 had previously been amended to state that a fluid-free (e.g., not hydraulic) transmission is driven by the electric motor. Support for this amendment can be found within Applicants' originally filed Figures 6 and 9, as well as the accompanying text. This amendment further highlights the incompatibility, and lack of suggestion and motivation to combine the hydraulic system of IBEC with the electric motor actuator of Speller. Clew and the many secondary considerations provide ample evidence of nonobviousness of the presently claimed invention.

Furthermore, independent Claim 50 had previously been amended to state that a fluid-free transmission is used which is coupled to the electric motor during normal motor use. In contrast, Speller teaches that "a single actuator 80 can thus be provided for operation of all the tools 180, 182, 184, 186, and 188" such that a riveting transmission is not always coupled to the motor. See column 7, lines 23-25, and Figure 9 of Speller. Radical reengineering would be required to combine the hydraulic drive of IBEC with the multi-tool system of Speller given the improper benefit of hindsight reasoning using the presently claimed invention as a template. Clew and the secondary considerations also teach away from this combination. The Examiner's note alleging obvious matters of design choice with regard to the claimed stationary die being aligned with the punch in Claim 50 is respectfully challenged, as this claimed feature again highlights the extreme differences between Speller and the present invention.

The Examiner has ignored the secondary considerations of commercial success, licensing and industry significance as presented in the Declarations under 37 C.F.R. §1.132 by inventor D. Mauer, assignee's product manager Ralf England,

customer H. Konig of Audi and the EWI License. These Declarations and especially the EWI License are clear that the commercial success and significance in the industry are primarily based on the technical merit of the claimed invention. These Declarations and the EWI License must be given their proper objective and significant weight to defeat obviousness. See, *Stratoflex, Inc. v. Aeroquip Corp.*, 218 U.S.P.Q. 871, 880 (Fed. Cir. 1983 (secondary considerations must always . . . be considered”); see also, *Truswal Sys. Corp. v. Hydro-Air Eng’g. Inc.*, 2 U.S.P.Q.2d 1034, 1039 (Fed. Cir. 1987) (“secondary in time does not mean that it is secondary in importance”).

None of the references cited by the Examiner disclose all of the above mentioned features, nor is there a suggestion or motivation to combine the cited references, and therefore, the claims at issue are patentably distinct over the cited references. In contrast to the Examiner’s incorrect assertions, there is no suggestion or motivation to combine the electrically driven machine of Speller with the hydraulically actuated machine of the IBEC reference. To the contrary, the third party, Audi employee declaration of Konig states, in paragraph 6, that the electric motor driven, rotary-to-linear transmission, with sensor control “technology here employed is not to our knowledge usable for other, e.g., hydraulic, systems.” (emphasis added). This is the statement from a third party customer, Audi, who was comparing a hydraulically driven self piercing riveting machine to the Emhart Tucker riveting machine disclosed and claimed in the present application.

Moreover, Speller, at column 1, lines 20-27, and in column 2, lines 11-18, teaches away from and discourages the use of hydraulics for riveting machines. See generally, *Winner Int’l Royalty Corp. v. Wang*, 53 U.S.P.Q.2d 1580, 1588 (Fed. Cir.

2000), *cert. denied*, 530 U.S. 1238 (Fed. Cir. 2000 (if a reference teaches away then that fact alone can defeat obviousness)). Significant reengineering would be required to combine these two cited devices if that is even possible; it would clearly not be desirable given the background of the Speller patent and statement of the Audi employee. This is even more significant given that the Speller patent is primarily intended for use to upset a two sided rivet adjacent the anvil 50 and not actually to receive and drive the rivet itself into a workpiece (see column 4, lines 4-8 of the '115 patent).

As further evidence of secondary considerations supporting nonobviousness, Ekdahl et al. (U.S. Patent No. 5,727,300) explains, throughout columns 1 and 2, that there is a long felt but unsolved need for real time rivet inspection, that is being solved by the present invention. It is noteworthy that both the Ekdahl and Speller patents pertain to the same aircraft riveting industry.

In the present situation, even if the cited references disclose the features incorrectly alleged by the Examiner, the suggestion or motivation to combine the disparate references to arrive at the elements as presently claimed, is severely lacking. The claimed invention has been improperly used as a template to combine these assorted and far flung elements, thereby requiring the Board to withdraw and overturn the instant rejection. The secondary considerations of commercial success, licensing, significance in the industry, long felt but unsolved need, and teaching away from by others require a finding of nonobviousness of the presently claimed invention.

#### 4. Legal and Factual Errors by Examiner for Dependent Claims

The Examiner has made further factual errors with regard to the dependent claims. There is no teaching, suggestion or motivation by the cited references for the new and nonobvious combination of the present claim elements, especially when the additional elements of each of the dependent claims are considered. For example, none of the cited references specifically teach the additional feature of an electric motor torque sensor as claimed in dependent Claim 20. Additionally, none of the cited references specifically teach the flushness determination of dependent Claim 53. With all due respect, the Examiner is simply mistaken in his reading and application of the prior art, and lack of suggestion to combine same. Accordingly, it is respectfully requested that the Examiner's rejection should be reversed.

#### E. 35 U.S.C. §103 Rejection of Claims 51 and 52

Claims 51 and 52 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al. and IBEC in view of Gast (U.S. Patent No. 4,901,431). This rejection is respectfully traversed. All of the originally filed claims are believed to be patentably distinct over the cited references.

Furthermore, there is no suggestion or motivation for combining the cited references, especially since significant reengineering would be required to combine the hydraulic/pneumatic systems of IBEC and Gast with the screw drive system of Speller (which teaches away from such a combination (see column 1, lines 20-27 and column 2, lines 11-18, of Speller, and the background of Clew)). Notwithstanding, this rejection

is deemed moot in light of the base independent claims. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

F. 35 U.S.C. §103(a) Rejection of Claim 16

Claim 16 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al. and IBEC in view of Zeldman et al. (U.S. Patent No. 3,878,734). This rejection is respectfully traversed. It is believed that the originally filed claim is patentably distinct over the cited references.

The suggestions for this combination are lacking and, moreover, the significant secondary considerations and the teachings away by Clew weigh in favor of nonobviousness. Notwithstanding, this rejection is deemed moot in light of the base independent claim. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

G. 35 U.S.C. §103 Rejection of Claims 22-30, 33, 34, 43, 44, 56, 57 and 59-61

Claims 22-30, 33, 34, 43, 44, 56, 57 and 59-61 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al. in view of Cotterill et al. (U.S. Patent No. 5,752,305). This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the references cited.

1. Legal and Factual Errors by the Examiner

Independent Claim 43 had previously been amended to state that the transmission is always coupled to the electric motor during normal motor actuation.

Support for this amendment can be found in originally filed Figures 6 and 9 as well as the accompanying text. Speller teaches a radically different construction as discussed in its column 7, lines 23-25.

In contrast to the Examiner's assertions, the presently claimed combination of elements in Claims 22-30, 33, 34, 43, 44, 56, 57 and 59-61 is new and nonobvious. None of the references cited by the Examiner disclose the above mentioned features, nor is there a suggestion or motivation to combine the cited references, and therefore, the claims at issue are patentably distinct over the cited references. The Examiner has improperly employed hindsight reconstruction by using the patent-in-suit as a template.

More specifically, there is no suggestion or motivation to combine the electrically driven machine of Speller with the hydraulically actuated machine of the Cotterill reference. To the contrary, the Audi third party, employee declaration of Konig states that in paragraph 6 that the "technology here employed is not to our knowledge usable for other, e.g., hydraulic, systems." (emphasis added). This is the statement from a third party customer, Audi, who was comparing a hydraulically driven self piercing riveting machine to the Emhart Tucker riveting machine disclosed and claimed in the present application.

Furthermore, Speller, at column 1, lines 20-27, and in column 2, lines 11-18, teaches away from and discourages the use of hydraulics for riveting machines. See generally, *Winner Int'l Royalty Corp. v. Wang*, 53 U.S.P.Q.2d 1580, 1588 (Fed. Cir. 2000), *cert. denied*, 530 U.S. 1238 (2000) (if a reference teaches away then that fact alone can defeat obviousness). Significant reengineering would be required to combine



these two cited devices if that is even possible; it would clearly not be desirable given the background of the Speller patent and statement of the Audi employee. This is even more significant given that the Speller patent is primarily intended for use to upset a rivet adjacent the anvil 50 and not actually to receive and drive the rivet itself into a workpiece (see column 4, lines 4-8 of the '115 patent).

Moreover, it is significant that the electric motor disclosed in Speller upsets a conventional two-sided rivet on the anvil or die side of the machine. (See column 4, lines 4-10 of '115 patent). The Speller device is intended for use with a drill, a hole probe, a shave tool, a seal tool and a riveter in order to predrill a hole in the work piece, insert the rivet and upset the rivet. (See column 6, lines 50-54 and Figure 9 of '115 patent). This is significantly different than the self piercing rivet operation employed in the Cotterill reference and as claimed at elements (e) and (f) in Claim 22, element (c) of Claim 34, as element (c) of Claim 43, and on the eighth line of Claim 56 (as shown in Appendix A) . There is no suggestion or motivation to combine these very different types of fasteners.

As further evidence of secondary considerations supporting nonobviousness, Ekdahl explains, throughout columns 1 and 2, that there is a long felt but unsolved need for real time rivet inspection, that is being solved by the present invention. Also, column 5, lines 12 and 13, of Ekdahl teaches drilling before the rivet is inserted, thereby teaching away from the presently claimed invention's use of self piercing rivets (for the applicable claims in the present application). The Clew patent, commonly assigned with Cotterill, also teaches away from this combination.

By way of further example, element (c) of Claim 34 includes setting the rivet “by the punch acting with a substantially relatively stationary die.” The movable anvil of Speller teaches away from this feature. It is also noteworthy that neither Speller nor Cotterill teach, suggest or motivate “a sensor operable to indicate power consumption of the electric motor” as is claimed in independent Claim 43 as part of element (d).

In the present situation, even if the cited references disclose the features incorrectly alleged by the Examiner, the suggestion or motivation to combine the disparate references to arrive at the elements as presently claimed, is severely lacking. The claimed invention has been improperly used as a template to combine these assorted and far flung elements, thereby requiring reversal of the instant rejection. The secondary considerations of commercial success, licensing, industry significance, long felt but unsolved need, and teaching away from by others, as demonstrated by the Declarations, EWI License, and noted references further require a finding of nonobviousness of the presently claimed invention. Furthermore, the Examiner’s statement as to obvious design choices and inherency are respectfully challenged as lacking support, especially when viewed in combination with the other claim elements. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

## 2. Legal and Factual Errors by the Examiner for Dependent Claims

The Examiner has made further factual errors with regard to the dependent claims. There is no teaching, suggestion or motivation by the cited

references for the new and nonobvious combination of the present claim elements, especially when the additional elements of each of the dependent claims are considered. For example, the Examiner cannot even find any reference to support his vague and unsupported “design choice,” “conventional in the ad [sic]” and “old and well known” assertions. These baseless comments by the Examiner are not evidence and do not show obviousness. As an example, what prior art teaches the offset nature of Claim 60? Accordingly, it is respectfully requested that the Board reverse the instant rejection.

H. 35 U.S.C. §103 Rejection of Claims 31, 32, 35-42 and 45-47

The Examiner has rejected Claims 31, 32, 35-42 and 45-47 under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al., Cotterill et al. and Gast. This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references.

In contrast to the Examiner’s assertions, the presently claimed combination of elements in Claims 31, 32, 35, 42 and 45-47 is new and nonobvious. None of the references cited by the Examiner disclose the above mentioned features, nor is there a suggestion or motivation to combine the cited references, and therefore, the claims at issue are patentably distinct over the cited references. The secondary considerations of commercial success, licensing, industry significance, long felt but unsolved need, and teaching away from by others, as demonstrated by the Declarations, and especially the EWI License and noted references further require a finding of nonobviousness of the presently claimed invention. Furthermore, the Examiner’s

statement as to design choice is respectfully challenged as lacking support, especially when considered with the combination of other claim elements. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

I. 35 U.S.C. §103 Rejection of Claim 48

Claim 48 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al. in view of IBEC and Gast. This rejection is respectfully traversed. The originally filed claim is believed to be patentably distinct over the cited references.

In contrast to the Examiner's assertions, the presently claimed combination of elements in Claims 48 is new and nonobvious. None of the references applied by the Examiner teach the offset motor and punch element claimed at (b). Furthermore, "virtually all inventions are combinations of old elements" such that "rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be an illogical and inappropriate process by which to determine patentability." *In re Rouffet*, 47 U.S.P.Q.2d at 1457. Furthermore, the references applied by the Examiner do not contain the requisite suggestion or motivation necessary to show obviousness of the claimed invention. *See, Smith Indus. Medical Sys. Inc.*, 51 U.S.P.Q.2d at 1420-21.

The Examiner has ignored or improperly discounted the secondary considerations as presented in the Declarations and EWI License. These Declarations and the EWI License must be given their proper objective and significant weight to

defeat obviousness. See, *Stratoflex, Inc.*, 218 U.S.P.Q. at 880 (“secondary considerations must always . . . be considered”); see also, *Truswal Sys. Corp.*, 2 U.S.P.Q.2d at 1039 (“secondary in time does not mean that it is secondary in importance”).

None of the references cited by the Examiner disclose the above mentioned features, nor is there a suggestion or motivation to combine the cited references, and therefore, the claims at issue are patentably distinct over the cited references. “Care must be taken to avoid hindsight reconstruction by using the patent-in-suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit.” *Grain Processing Corp.*, 5 U.S.P.Q.2d at 1792. The Examiner should not “pick and choose among the individual elements of assorted prior art references to recreate the claimed invention.” *Symbol Technologies Inc.*, 19 U.S.P.Q.2d at 1246. The Examiner must identify the explicit statements in the prior art that demonstrate the alleged motivation, suggestion or teaching, and broad “conclusory statements standing alone are not ‘evidence’.” *In re Kotzab*, 55 U.S.P.Q.2d at 1317. In this regard, the Examiner has respectfully failed.

In contrast to the Examiner’s incorrect assertions, there is no suggestion or motivation to combine the electrically driven machine of Speller with the hydraulically actuated machine of the IBEC reference and the pneumatically driven slide 54 of Gast. To the contrary, the third party, Audi employee declaration of Konig states that in paragraph 6 that the “technology here employed is not to our knowledge usable for other, e.g., hydraulic, systems.” (emphasis added). This is the statement from a third

party customer, Audi, who was comparing a hydraulically driven self piercing riveting machine to the Emhart Tucker riveting machine disclosed and claimed in the present application.

Moreover, Speller, at column 1, lines 20-27, and in column 2, lines 11-18, teaches away from and discourages the use of hydraulics for riveting machines. See *generally, Winner Int'l Royalty Corp.*, 53 U.S.P.Q.2d at 1588 (if a reference teaches away then that fact alone can defeat obviousness). Significant reengineering would be required to combine these two cited devices if that is even possible; it would clearly not be desirable given the background of the Speller patent and statement of the Audi employee. This is even more significant given that the Speller patent is primarily intended for use to upset a rivet adjacent the anvil 50 and not actually to receive and drive the rivet itself into a workpiece (see column 4, lines 4-8 of the '115 patent). Clew also teaches away from making this combination.

In the present situation, even if the cited references disclose the features incorrectly alleged by the Examiner, the suggestion or motivation to combine the disparate references to arrive at the elements as presently claimed, is severely lacking. The claimed invention has been improperly used as a template to combine these assorted and far flung elements, thereby requiring reversal of the instant rejection. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

J. 35 U.S.C. §103 Rejection of Claims 49 and 55

Claims 49 and 55 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al., IBEC, Gast and Cotterill et al. This

rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references.

Further in contrast to the Examiner's assertions, the presently claimed combination of elements in Claims 49 and 55 is new and nonobvious. None of the references cited by the Examiner disclose the above mentioned features, nor is there a suggestion or motivation to combine the cited references, and therefore, the claims at issue are patentably distinct over the cited references. The claimed invention has been improperly used as a template to combine these assorted and far flung elements, and the secondary considerations have been ignored, thereby requiring reversal of the instant rejection. For example, the Examiner has also made unsupported assumptions regarding the flushness of the rivet head and the controller determination thereof (see Claim 55). Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

K. 35 U.S.C. §103(a) Rejection of Claim 58

The Examiner has rejected Claim 58 under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al., Cotterill et al. and the Affidavit of John Vrana. This rejection is respectfully traversed. It is believed that the originally filed claim is patentably distinct over the cited references.

First, the Affidavit of Vrana is defective since it does not say that it is based on personal knowledge. See, 37 C.F.R. §1.68 and M.P.E.P. §715.04. Furthermore, all of the statements in section numbers 3-6 cannot be considered as "prior art" under 35 U.S.C. since there is no time reference disclosed in the Affidavit and since the Affidavit was allegedly signed in 2001, well after the priority filing date for the

present application. Regardless, this Affidavit does not overcome the significant inability to combine the hydraulic drive of Cotterill with the electric drive of Speller especially in view of the teaching away from such and secondary considerations previously discussed herein. Again, the Examiner appears to be improperly using hindsight reasoning in combining these disparate references given the benefit of the present invention as a template. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

L. 35 U.S.C. §103(a) Rejection of Claim 62

Claim 62 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al., Cotterill et al., IBEC and Gast. This rejection is respectfully traversed. It is believed that the originally filed claim is patentably distinct over the cited references. In contrast to the Examiner's incorrect hindsight assertions, there is no suggestion or motivation to combine the electrically driven machine of Speller with the hydraulically actuated machines of Cotterill and IBEC, and the pneumatically driven slide of Gast. Speller, Clew and the Audi declaration of Konig teach away from such a combination. For example, Speller teaches away from the claimed "die always aligned with the plunger." *See generally, Winner Int'l. Royalty Corp.*, 53 U.S.P.Q.2d at 1588. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.



M. 35 U.S.C. §103(a) Rejection of Claims 63 and 71

Claims 63 and 71 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al. in view of Cotterill and the Affidavit of Vrana. This rejection is respectfully traversed. The originally filed claims are patentably distinct over the cited references.

The Vrana Affidavit is defective as previously discussed. Furthermore, none of the references applied by the Examiner teach the offset motor and member element claimed in independent Claim 63. Moreover, none of the references applied by the Examiner teach the monitoring unit operably determining whether a portion of the rivet is flush with a workpiece surface as recited at (e) of independent Claim 71.

The presently claimed combination of elements in all of the claims is new and nonobvious. "Virtually all inventions are combinations of old elements" such that "rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be an illogical and inappropriate process by which to determine patentability." *In re Rouffet*, 47 U.S.P.Q.2d at 1457. Furthermore, the references applied by the Examiner do not contain the requisite suggestion or motivation necessary to show obviousness of the claimed invention. *See, Smith Indus. Medical Sys. Inc.*, 51 U.S.P.Q.2d at 1420-21.

None of the references cited by the Examiner disclose all of the above mentioned features, nor is there a suggestion or motivation to combine the cited references, and therefore, the claims at issue are patentably distinct over the cited

references. "Care must be taken to avoid hindsight reconstruction by using the patent-in-suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit." *Grain Processing Corp.*, 5 U.S.P.Q.2d at 1792. The Examiner should not "pick and choose among the individual elements of assorted prior art references to recreate the claimed invention." *Symbol Technologies Inc.*, 19 U.S.P.Q.2d at 1246. The Examiner must identify the explicit statements in the prior art that demonstrate the alleged motivation, suggestion or teaching, and broad "conclusory statements standing alone are not 'evidence'." *In re Kotzab*, 55 U.S.P.Q.2d at 1317. In this regard, the Examiner has respectfully failed.

In contrast to the Examiner's incorrect hindsight assertions, there is no suggestion or motivation to combine the electrically driven machine of Speller with the hydraulically actuated machine of Cotterill. To the contrary, the third party, Audi employee declaration of Konig states, in paragraph 6, that the electric motor driven, rotary-to-linear transmission, with sensor control "technology here employed is not to our knowledge usable for other, e.g., hydraulic, systems." (emphasis added). This is the statement from a third party customer, Audi, who was comparing a hydraulically driven self piercing riveting machine to the Emhart Tucker riveting machine disclosed and claimed in the present application.

Moreover, Speller, at column 1, lines 20-27, and in column 2, lines 11-18, teaches away from and discourages the use of hydraulics for riveting machines. See generally, *Winner Int'l Royalty Corp.*, 53 U.S.P.Q.2d at 1588 (if a reference teaches away then that fact alone can defeat obviousness). Significant reengineering would be

required to combine these two cited devices if that is even possible; it would clearly not be desirable given the background of the Speller patent and statement of the Audi employee. This is even more significant given that the Speller patent is primarily intended for use to upset a two sided rivet adjacent the anvil 50 and not actually to receive and drive the rivet itself into a workpiece (see column 4, lines 4-8 of the '115 patent).

As further evidence of secondary considerations supporting nonobviousness, Ekdahl explains, throughout columns 1 and 2, that there is a long felt but unsolved need for real time rivet inspection, that is being solved by the present invention.

In the present situation, even if the cited references disclose the features incorrectly alleged by the Examiner, the suggestion or motivation to combine the disparate references to arrive at the elements as presently claimed, is severely lacking. The claimed invention has been improperly used as a template to combine these assorted and far flung elements, thereby requiring the Examiner to withdraw and overturn the instant rejection. Speller, Clew and the Audi declaration of Konig teach away from such a combination. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

N. 35 U.S.C. §103(a) Rejection of Claims 64-77

Finally, the Examiner has rejected Claims 64-77 under 35 U.S.C. §103(a) as allegedly being unpatentable over Speller, Jr. et al., Cotterill et al., the Affidavit of

Vrana and IBEC. This rejection is respectfully traversed. It is believed that the originally filed claims are patentably distinct over the cited references.

1. Legal and Factual Errors by Examiner

First, the cited references do not teach paragraph (c) of independent Claim 71. Second, the Vrana Affidavit is defective as previously discussed.

Third, the presently claimed combination of elements in all of the claims is new and nonobvious. The references applied by the Examiner do not contain the requisite suggestion or motivation necessary to show obviousness of the claimed invention. *See, Smith Indus. Medical Sys. Inc.*, 51 U.S.P.Q.2d at 1420-21. The Examiner has also improperly used hindsight reasoning. *See, Grain Processing Corp.*, 5 U.S.P.Q.2d at 1782.

In contrast to the Examiner's incorrect hindsight assertions, there is no suggestion or motivation to combine the electrically driven machine of Speller with the hydraulically actuated machines of Cotterill and IBEC. To the contrary, the third party, Audi employee declaration of Konig states, in paragraph 6, that the electric motor driven, rotary-to-linear transmission, with sensor control "technology here employed is not to our knowledge usable for other, e.g., hydraulic, systems." (emphasis added). This is the statement from a third party customer, Audi, who was comparing a hydraulically driven self piercing riveting machine to the Emhart Tucker riveting machine disclosed and claimed in the present application.

Moreover, Speller, at column 1, lines 20-27, and in column 2, lines 11-18, teaches away from and discourages the use of hydraulics for riveting machines. *See*

generally, *Winner Int'l Royalty Corp.*, 53 U.S.P.Q.2d at 1588 (if a reference teaches away then that fact alone can defeat obviousness). Significant reengineering would be required to combine these two cited devices if that is even possible; it would clearly not be desirable given the background of the Speller patent and statement of the Audi employee. This is even more significant given that the Speller patent is primarily intended for use to upset a two sided rivet adjacent the anvil 50 and not actually to receive and drive the rivet itself into a workpiece (see column 4, lines 4-8 of the '115 patent).

As further evidence of secondary considerations supporting nonobviousness, Ekdahl explains, throughout columns 1 and 2, that there is a long felt but unsolved need for real time rivet inspection, that is being solved by the present invention.

## 2. Legal and Factual Errors by Examiner for Dependent Claims

The Examiner has made further factual errors with regard to the dependent claims. There is no teaching, suggestion or motivation by the cited references for the new and nonobvious combination of the present claim elements, especially when the additional elements of each of the dependent claims are considered. For example, the cited references do not teach at least the features of a determination of power consumption (Claims 68 and 73), torque (Claims 69 and 75) or flushness (Claim 70); or imperforated automotive vehicle panels (Claim 76), or the stroke motion and aligned die/punch (Claim 77), especially when combined with the other claim elements.

In the present situation, even if the cited references disclose the features incorrectly alleged by the Examiner, the suggestion or motivation to combine the disparate references to arrive at the elements as presently claimed, is severely lacking. The claimed invention has been improperly used as a template to combine these assorted and far flung elements in hindsight, thereby requiring the Board to withdraw and overturn the instant rejection. Speller, Clew and the Audi declaration of Konig teach away from such a combination. Accordingly, it is respectfully requested that the instant rejection be reversed and withdrawn.

#### **IX. CONCLUSION**

For the foregoing reasons, the Examiner's rejections should be reversed and the rejected Claims 12, 15, 16 and 18-77 (in addition to those already allowed by the Examiner) allowed at the earliest possible date.

Respectfully submitted,

Dated: August 1, 2005

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## APPENDIX A

### CLEAN CLAIMS FOR 0275M-000260/DVB

1. An electronic control system for use in a riveting process, the system comprising:

an electronic control unit;

an electric motor connected to the electronic control unit;

a first sensor connected to the electronic control unit and the electric motor, the first sensor being operable to indicate at least one of: (a) torque of the electric motor, (b) speed of the electric motor, and (c) an electrical power characteristic of the electric motor; and

at least a second sensor connected to the electronic control unit, the second sensor operably detecting a riveting characteristic occurring during the riveting process, the riveting characteristic consisting essentially of at least one of: (a) riveting force, (b) rivet punch assembly location, (c) rivet size, and (d) workpiece thickness;

the electronic control unit automatically varying the riveting process in a real-time manner in response to output from at least the first and second sensors.

2. The system of Claim 1 further comprising a rivet and a riveting machine which includes the electric motor, the riveting machine operably moving the rivet.

3. The system of Claim 2 further comprising:  
a rivet feeder having an actuator connected to the electronic control unit; and  
a feed tube sensor connected to the electronic control unit;  
wherein the electronic control unit operably controls feeding of the rivet by the feeder during the riveting process and the feed tube sensor sends a signal to the electronic control unit indicative of the presence of the rivet.

4. The system of Claim 1 further comprising a punch and a fluid-free transmission, the transmission being operable to convert rotary motion of the electric motor to linear motion driving the punch, the transmission always being coupled to the electric motor and the punch always being coupled to the transmission during electric motor actuation.

5. The system of Claim 4 wherein the transmission includes a closed loop belt.

6. The system of Claim 1 wherein the riveting characteristic sensed by the second sensor is the riveting force.

7. The system of Claim 1 wherein the riveting characteristic sensed by the second sensor is the rivet punch assembly location.



8. The system of Claim 1 wherein the riveting characteristic sensed by the second sensor is a rivet size.

9. The system of Claim 1 wherein the riveting characteristic sensed by the second sensor is a workpiece thickness.

10. The system of Claim 1 wherein the second sensor is a load cell operably indicating a linearly moving member force.

11. The system of Claim 1 wherein the second sensor is a proximity switch.

12. A riveting electrical control system comprising:

- (a) an electrical control unit;
- (b) an electric motor connected to the electrical control unit;
- (c) a fluid-free transmission operably driven by energization of the electric motor;
- (d) a riveting punch operably advanced by the transmission; and
- (e) a sensor connected to the electrical control unit, the sensor being operable to sense riveting force.

13. The system of Claim 12 further comprising a rivet operably driven by the punch, the electrical control unit automatically varying a characteristic associated with the punch in response to the sensed riveting force.

14. The system of Claim 13 further comprising:  
a rivet feeder having an actuator connected to the electronic control unit; and  
a feed tube sensor connected to the electronic control unit;  
wherein the electronic control unit operably controls feeding of the rivet by the feeder during the riveting process and the feed tube sensor sends a signal to the electronic control unit indicative of the presence of the rivet.

15. The system of Claim 12 wherein the transmission operably converts rotary motion of the electric motor to linear motion for moving the punch.

16. The system of Claim 15 wherein the transmission includes a closed loop belt.

17. The system of Claim 12 wherein a second riveting characteristic is sensed in real-time for use by the electrical control unit.

18. The system of Claim 12 further comprising a second sensor operably sensing an electrical power characteristic of the electric motor.

19. The system of Claim 12 further comprising a second sensor operably sensing a speed of the electric motor.

20. The system of Claim 12 further comprising a second sensor operably sensing a torque of the electric motor.

21. The system of Claim 12 wherein the electric control unit is a programmable computer.

22. A riveting electrical control system comprising:

- (a) an electrical control unit;
- (b) an electric motor connected to the electrical control unit;
- (c) a transmission operably driven by energization of the electric motor, the transmission operably converting rotational movement of the electric motor to substantially linear movement;
- (d) a riveting punch operably advanced in a substantially linear direction by the transmission;
- (e) a self-piercing rivet operably driven by the punch as controlled by the electrical control unit; and
- (f) a die operably diverging an end of the rivet without the rivet piercing completely through the exterior surface of a die-side workpiece adjacent the die;

the electric control unit operably controlling energization of the electric motor and operably determining if an undesired riveting condition is present.

23. The system of Claim 22 further comprising a sensor connected to the electrical control unit, the sensor being operable to sense a characteristic of the electric motor, wherein the characteristic changes at least in part due to varying rivet setting performance.

24. The system of Claim 23 wherein the characteristic is an electrical power characteristic of the electric motor.

25. The system of Claim 24 wherein the electrical power characteristic is electrical current.

26. The system of Claim 23 wherein the electrical control unit compares a signal from the sensor to previously stored data.

27. The system of Claim 22 wherein a rotational axis of the electric motor is offset from a centerline coaxial with an advancing direction of the punch.

28. The system of Claim 27 wherein the motor axis is substantially parallel to the punch centerline.

29. The system of Claim 22 wherein the electrical control unit includes a programmable microprocessor which automatically varies a riveting process based at least in part on the determination.

30. The system of Claim 22 wherein the electronic control unit automatically operably causes varying sized self piercing rivets to be operably driven by the punch.

31. The system of Claim 22 wherein the transmission is always coupled to the electric motor, and the electrical control unit transmits an error signal if the undesired condition is present.

32. The system of Claim 22 wherein the electrical control unit stops the rivet process if the undesired condition is present.

33. The system of Claim 22 wherein the electrical control unit determines if a riveting characteristic is within a desired range.

34. A control system comprising:

- (a) a programmable control unit;
- (b) a riveting machine including an electric motor and a transmission operable to convert rotary motion of the electric motor to linear motion of a punch;
- (c) a self piercing rivet operably set by the punch acting with a substantially relatively stationary die of the riveting machine when the control unit causes energization of the electric motor; and
- (d) a feeder operable to transfer the rivet to the riveting machine.

35. The system of Claim 34 further comprising a sensor located adjacent the rivet machine, the control unit being operable to receive a signal generated by the sensor.

36. The system of Claim 35 wherein the control unit compares the signal generated by the sensor to previously stored data.

37. The system of Claim 35 wherein the sensor is attached to the rivet machine, the transmission comprises a spindle and a nut enmeshed with the spindle, and the transmission is always coupled to the electric motor.

38. The system of Claim 35 wherein the sensor is operable to indicate a characteristic of the electric motor and the control unit varies the operation of the riveting machine during riveting based at least in part on output from the sensor.

39. The system of Claim 34 wherein the control unit is operable to control actuation of the rivet feeder.

40. The system of Claim 34 further comprising an articulating robot, the riveting machine being attached to and positioned by the robot.

41. The system of Claim 34 wherein the control unit transmits an error signal if an undesired condition is present.

42. The system of Claim 34 wherein the electrical control unit determines if a riveting characteristic is within a desired range, the rivet being of a hollow and diverging type with a solid head.

43. A control system comprising:

(a) a programmable controller;

(b) a riveting machine including an electric motor and a transmission always coupled to the electric motor during motor actuation, the

transmission being operable to convert rotary motion of the electric motor to substantially linear motion;

(c) a rivet operably moved by the riveting machine when the controller causes energization of the electric motor, the rivet being of a hollow and diverging type with a solid head; and

(d) a sensor operable to indicate power consumption of the electric motor, the controller operably receiving a signal generated by the sensor.

44. The system of Claim 43 wherein the controller compares the signal generated by the sensor to previously stored values.

45. The system of Claim 43 further comprising a rivet feeder connected to the riveting machine, the controller operably controlling actuation of the rivet feeder.

46. The system of Claim 43 further comprising an articulating robot, the riveting machine being attached to and positioned by the robot.

47. The system of Claim 43 wherein the transmission includes an endless belt.



48. A control system comprising:

- (a) a programmable controller;
- (b) a riveting machine including an electric motor and a transmission, the transmission being operable to convert rotary motion of the electric motor to linear motion, a section of the electric motor being rotatable about an axis offset from a centerline coaxial with an elongated dimension of the punch;
- (c) a rivet operably moved by the riveting machine when the controller causes energization of the electric motor;
- (d) a sensor operable to indicate a riveting force characteristic, the controller operably receiving a signal generated by the sensor;
- (e) an articulating robot, the riveting machine being attached to and positioned by the robot; and
- (f) a rivet feeder connected to the riveting machine, the controller operably controlling actuation of the rivet feeder.

49. The system of Claim 48 wherein the controller compares the signal generated by the sensor to previously stored data, and the rivet having a solid head and a diverging open end which does not completely penetrate a workpiece farthest from the head.

50. A riveting electrical control system comprising:

- (a) an electrical control unit;
- (b) an electric motor connected to the electrical control unit;
- (c) a fluid-free mechanical transmission operably converting rotational movement of the electric motor to substantially linear movement, the transmission being coupled to the electric motor during motor use;
- (d) a rivet setting punch operably advanced by the transmission;
- (e) a substantially stationary die always aligned with the punch;

and

- (f) the electrical control unit operably determining if a riveted joint is within a desired range.

51. The system of Claim 50 wherein the electrical control unit stops the rivet process if the undesired condition is present.

52. The system of Claim 50 wherein the electrical control unit transmits an error signal if the undesired condition is present.

53. The system of Claim 50 wherein the electrical control unit includes a programmable microprocessor which compares sensed data to other data, and the electrical control unit continuously compares actual workpiece thickness signals to previously stored workpiece thickness signals substantially during rivet setting.

54. The system of Claim 50 wherein the electrical control unit operably determining if a riveted joint is within a desired range includes determining if a portion of a rivet is essentially flush with a punch-side workpiece outer surface without completely piercing through a die-side workpiece.

55. The system of Claim 48 wherein the controller determines if a head of the rivet is essentially flush with a punch-side workpiece outer surface without completely piercing through a die-side workpiece.

56. A riveting system comprising:

- an electric motor;
- a rotatable member operably driven by energization of the motor;
- a transmission serving to convert rotary motion of the rotatable member to linear motion;
- a plunger coupled to the transmission and being movable in a linear direction;
- a self piercing rivet operably driven by the plunger, the rivet being at least partially hollow; and
- a data monitoring unit electrically connected to at least one of: (a) the motor, and (b) the transmission.

57. The system of Claim 56 further comprising:  
a housing surrounding a portion of the plunger;  
a die;  
a substantially C-shaped frame attaching the die to the housing;  
and  
a workpiece clamp coupled to the transmission and being linearly  
movable.

58. The system of Claim 57 wherein the plunger and clamp are  
movable together at a first speed during advancing movement, and the plunger is  
subsequently movable at a second speed slower than the first speed when the  
clamp is substantially stationary during rivet-to-workpiece engagement.

59. The system of Claim 56 wherein the transmission includes a  
circulating ball spindle drive, further comprising a workpiece clamp operably  
driven by the spindle drive.

60. The system of Claim 56 wherein the motor has a rotational  
axis offset from an elongated centerline of the plunger.

61. The system of Claim 56 further comprising a punch-side  
workpiece and a die-side workpiece, the rivet completely piercing the punch-side  
workpiece but being prevented from completely piercing the die-side workpiece.

62. The system of Claim 56 further comprising:

a sensor connected to the monitoring unit;

the sensor being operable to detect at least one of: (a) clamp travel, (b) plunger advancing force, (c) clamp advancing force, (d) actuator power consumption, (e) actuator torque, and (f) transmission torque;

the sensor operably sending the detected information to the monitoring unit in order to determine the actual riveted joint condition;

a die always aligned with the plunger;

a frame securing the die; and

a robotic arm coupled to the frame.

63. A riveting system comprising:

an electric motor;

a transmission serving to convert rotary motion of the motor to linear motion;

a member coupled to the transmission and being movable in a linear direction;

a self piercing rivet operably driven by the member;

a linearly movable workpiece clamp coupled to the transmission;

the motor having a rotational axis offset from an elongated centerline of the member and the rotational axis of the motor being substantially parallel to the centerline of the member; and

a member-side workpiece and a die-side workpiece, the rivet completely piercing the member-side workpiece but being prevented from completely piercing the die-side workpiece;

the member and clamp being initially movable together at a first speed during advancing movement, and the plunger being subsequently movable at a second speed slower than the first speed when the clamp is substantially stationary during rivet-to-workpiece engagement.

64. The system of Claim 63 further comprising:

a data monitoring unit electrically connected to the motor;

a first sensor connected to the monitoring unit;

the first sensor being operable to detect at least one of: (a) clamp travel, (b) member advancing force, (c) clamp advancing force, (d) motor power consumption, (e) motor torque, and (f) transmission torque;

the first sensor operably sending the detected information to the monitoring unit in order to determine the actual riveted joint condition; and

a second sensor operably detecting a riveting characteristic and sending a corresponding signal to the monitoring unit in a real time, substantially closed loop manner.

65. The system of Claim 63 further comprising a force transducer operable to sense force applied by at least one of : (a) the member, and (b) the clamp.

66. The system of Claim 63 further comprising a displacement transducer operable to sense displacement of the member.

67. The system of Claim 63 further comprising a monitoring unit operably determining the quality of the riveting procedure based on at least the force applied by the member during the riveting procedure.

68. The system of Claim 67 wherein the monitoring unit determines the force of the member based at least on the power consumption of the motor.

69. The system of Claim 63 further comprising a monitoring unit determining the member force based at least on the torque of at least one of: (a) the motor, and (b) the transmission.

70. The system of Claim 63 further comprising a monitoring unit operably determining whether a portion of the rivet is flush with a surface of the member-side workpiece.

71. A riveting control system comprising:

- (a) an electric motor;
- (b) a transmission operably converting rotary motion of the motor to linear motion;
- (c) a plunger coupled to the transmission and being movable in a linear direction;
- (d) a rivet operably advanced by the plunger; and
- (e) a data monitoring unit operably comparing a characteristic indicative of an actual riveted joint condition to a previously stored value, the monitoring unit operably determining whether a portion of the rivet is flush with a workpiece surface.

72. The system of Claim 71 further comprising:

- a first sensor connected to the monitoring unit operable to detect at least one of: (a) plunger advancing force, (b) clamp advancing force, (c) actuator power consumption, (d) actuator torque, and (e) transmission torque; and
- a second sensor connected to the monitoring unit operable to detect a riveting characteristic;

the sensors operably sending the detected information to the monitoring unit.



73. The system of Claim 71 further comprising a sensor, the monitoring unit operably determining the riveting force of the plunger based at least on the power consumption of the motor as sensed by the sensor, and subsequent riveting force being varied based on the sensed power consumption.

74. The system of Claim 71 further comprising a displacement transducer operable to sense displacement of the plunger.

75. The system of Claim 71 wherein the monitoring unit determines the plunger force based at least on the torque of at least one of: (a) the motor, and (b) the transmission.

76. The system of Claim 71 wherein the rivet is a self-piercing rivet which is at least partially hollow, operably driven by the plunger into an imperforated portion of automotive vehicle panels.

77. The system of Claim 71 wherein the rivet is inserted and fully secured by a single and substantially continuous stroke of the plunger, further comprising a substantially stationary die always aligned with the plunger.